

Things of science

received by a Group of Friends of Science;
sponsored and distributed without profit by
Science Service, the Institution for the Popu-
larization of Science, 1719 N Street, N.W.,
Washington 6, D. C. Watson Davis, Director.

INCENSE

Unit No. 254

Copyright © 1961 Science Service, Inc.

INCENSE

This unit of THINGS of science consists of eight scented incense cones, one scented incense stick; and specimens of gum tragacanth ribbons, gum arabic tears, and gum olibanum tears with which to make your own incense. The purpose of this unit is to acquaint you with incense and some of the materials used in its preparation.

First, identify the materials in this unit:

PINE-SCENTED INCENSE — Green cone.

SANDALWOOD-SCENTED INCENSE—Dark, tannish gold cone.

ROSE-SCENTED INCENSE — Rose colored cone.

WISTARIA-SCENTED INCENSE — Blue cone.

"ORIENTAL"-SCENTED INCENSE —Fuchsia cone.

VIOLET-SCENTED INCENSE—Purple cone.

JASMIN-SCENTED INCENSE—Yellow cone.

LOTUS-SCENTED INCENSE — Orange cone.

PIÑON-SCENTED INCENSE—Light tan stick about an inch long.

GUM TRAGACANTH RIBBON AND GUM ARABIC TEAR—Two gums in the same polyethylene bag. Gum tragacanth is the nearly white, translucent material in scale-like particles. Gum arabic is the lump (tear) form of no particular shape, and varies from a yellowish, amber colored material to a white.

GUM OLIBANUM TEAR (FRANKINCENSE)—Material in the other polyethylene bag. The color ranges from yellow to dark or reddish brown, and is covered with a light yellowish dust.

The word "incense" is derived from the Latin word meaning "to burn." As a noun, incense means any material burned or heated for its pleasant odor, its deodorizing effect, or its disinfecting property. Incense and fumigant are synonymous; however, when the word incense is used, one is more inclined to think of a substance that is burned for its perfume or fragrance than for its other qualities. Incense may be any material either natural or synthetic, liquid or solid, or a combination of these. These materials may be of both plant and animal substance.

Experiment 1. Examine the nine prepared incense pieces in the kit. Notice the odors of the eight incense cones

and the piñon stick. Do not light them yet, but compare their scents before burning. Can you identify the known scents? Does the odor of the green incense cone resemble that of the piñon incense? Compare the odors of these pieces of incense with soaps, perfumes, toilet articles, medicines, cleaning products, air deodorants and the like in your household. Can you find items that smell like the incense? Compare the odors of the incense pieces with the odors of the corresponding natural flowers or woods, if they are available.

The incense cones were colored with aniline dyes to facilitate identification of the scents. They are made of natural and synthetic materials. Some of the materials from which they are made are sandalwood, gum karaya, gum olibanum, etc.

Sandalwood is particularly interesting. It is the heartwood of an Indo-Malayan tree. Notice the incense cone which has sandalwood as its aromatic substance. It is used extensively in oriental incenses. There is written evidence of use of sandalwood as a perfume and in embalming prior to the fifth century B. C.

Piñon is a small tree of the pine fam-

ily that grows in the southwestern United States and Mexico. This is one native North American tree whose wood and needles provide aromatic materials specifically for the manufacture of incense and perfume. The incense stick in this kit is scented with piñon wood flour and a little oil from piñon needles. Entire villages in areas where these trees grow may smell of piñon because of the wood burning in fireplaces and outdoor ovens.

Experiment 2. Now examine the gum tragacanth ribbon. Does it have any odor? Break off a tiny bit of it and taste it. Does it have any flavor? Notice the texture when it is dry and when it is dampened on the tongue.

Tragacanth is the dried gum exuded by the *Astragalus* plant which is found in semi-desert areas of Asia, especially in Iran around the Mesopotamia district, including Arabistan and Kurdistan; and in Turkey.

Some of the uses of emulsions containing tragacanth are in the preparation of lotions and skin creams; pharmaceuticals; foods, such as mayonnaise, ice cream, syrups, confections, soft cheeses; and in other products. It is important in the textile industry. In printing cloth, tragacanth

acts as a thickening agent for the dyes used. It also prevents the colors from running together, and provides sharp, distinct prints. It is used to size paper and various cloths. Tragacanth is used in medicines chiefly to suspend insoluble powders in a fluid. It also emulsifies certain oils. It is a binding agent and may serve as a basis for greaseless creams, lotions, etc. Look for various preparations in your household which contain gum tragacanth.

Experiment 3. Examine the gum arabic. Does it have an odor? Break off a tiny bit of it and taste it. Does it have flavor? Notice the texture when it is dampened on the tongue. Does it seem to be more soluble than gum tragacanth?

Gum arabic is the dried gummy exudation from stems and branches of trees of the *Acacia* family. There are many types of this tree which grow in tropical and sub-tropical regions, chiefly of Africa, parts of Asia, and Australia. The best grades come from Kordofan in the Sudan. Gum acacia is the trade name for the purest grades of gum arabic which are used chiefly in pharmaceuticals and in food industries.

Gum arabic has been used since ancient times. It is known that the Egyptians used

it in making paint colors, and it was a commodity of Arab trade as long ago as 2000 B. C. This is why it is called gum arabic. Actually, most of it came from non-Arab Africa.

Some of the uses of gum arabic are in medicine, confectionery, textile processing, cosmetics, paper processing, adhesives, inks, foods, etc. It is frequently used with gum tragacanth to insure the stability of emulsions. It is still used as a fixer in the preparation of fine water colors. Without it, the colors would smudge or rub off. It has little medicinal value in itself but serves as an emulsion to which medicines are added. It is a binding agent and is used in making cosmetics, fumigating pastilles, lozenges, and such products. In medicine, it serves as a demulcent and as a colloid. It is part of a solution which is used in intravenous injections to raise blood pressure. In the textile and paper industries, gum arabic is used as a finisher, or to impart luster to these products. It is used to give body to various products. It is important in making candy of the gum types, and is used to make foods such as ice cream and syrups smooth.

Look for items in your household which

list gum arabic or acacia as ingredients.

There is still much to be learned about the chemical structure of these gums which are organic salts of complex nature.

Experiment 4. Examine the gum olibanum (frankincense) for its appearance, odor, taste, and texture, in the same manner used for examining the gum tragacanth and the gum arabic. Compare it with the two gums. It is different in color, odor, taste and texture. The name *gum olibanum* is misleading because it is an oil-gum-resin.

Frankincense is obtained from a small tree or shrub of the *Boswellia* family which grows in northeast Africa and southern Arabia.

The use of frankincense is ancient. It was an important object of trade between the Phoenicians and the Egyptians. There are wall carvings, dating about 1600 B. C. in a temple in Egypt, depicting a ship loaded with frankincense and frankincense plants on a voyage from Arabia to Egypt. Frankincense and myrrh were frequently mixed together and used in fumigation, medicine, and embalming.

Frankincense is mentioned throughout the Scriptures, and classical writers refer to it. It ranked in value with gold as a

gift from the wise men to Jesus Christ at his birth, according to the Christian Bible.

Today, frankincense is used mainly in the manufacture of incense. Its use in medicine is obsolete in most countries.

Experiment 5. Set the manufactured incense pieces on a surface that will not burn or scorch. Write the name of each scent on separate pieces of paper, and place them beside the appropriate incense pieces for identification. Note the odor of the first piece. Light it. It may burn with a flame for a few seconds, then smolder. Smell the odor given off by the smoldering incense. How does it compare with the odor before it was lighted? (Do not burn the pieces entirely if you wish to use them for future experiments.)

Allow the odor to fade before lighting the next piece, or take it into another room and light it. Proceed as with the first piece until you have noticed the odors of all nine pieces of smoldering incense. Compare the odor given off by each with the others. Are the scents of the smoldering incense as easily identified as the scents of the pieces before they were lighted?

Incense smoke should not be smelled

directly. The fumes of one scent should be allowed to penetrate the air. In fact, the effect of the fragrance is sometimes more agreeable after incense has stopped burning. In order to proceed with the experiments, it may be necessary to have more than one scent in the air at a time. Try to keep them separated, as far as possible.

Experiment 6. Now, begin to prepare some incense by first making a basic solution to which aromatic substances and a burning agent will be added later.

Make an emulsion of the gum tragacanth and the gum arabic. Be sure the two gums are very dry. First, pulverize them finely. This may be done by folding them in a thick cloth and pounding them with a hammer or other heavy object. Care must be taken to not break through the cloth. Make the powder as fine as possible. Put it in a small pyrex dish, such as a custard cup. Mix into it about two tablespoons of hot water. Put about one-half inch of water in a pan and bring it to a boil. Set the small dish containing the gums in the pan of boiling water. Continue boiling for about twenty minutes. Stir the mixture frequently. Be careful not to let the dish containing the gums turn over or the water to evaporate from

the pan. Remove the dish containing the gum mixture from the pan. The resulting emulsion should be thick and nearly clear. Notice that one of the gums has not completely dissolved. This is the gum tragacanth. A portion of gum tragacanth will not dissolve but will absorb large quantities of water to form a gel. Can you detect any odor or taste in this emulsion? Set it aside and allow to stand at least twenty-four hours. After this period of time, there should be very little, if any, solid material in the solution.

Experiment 7. While waiting for the gums to go into solution, prepare some charcoal powder for use in making a basic dough for your incense. Pulverize at least two ordinary charcoal bricks that are used in grills for cooking purposes. Do this in the same manner that the gums were powdered. The charcoal powder must be extremely fine, almost a dust. You may purchase wood charcoal powder at a drug store, if you prefer. Three or four ounces should be sufficient for the preparation of incense as described here.

Now add the charcoal powder to the solution of gum tragacanth and gum arabic, a little at a time, until the mixture becomes a stiff dough. The dough should be stiff enough to "knead" easily and

stay in one piece. This is a basic dough which, when dried, will burn slowly without a flame.

Experiment 8. Prepare some incense with particular odors using the basic dough.

First, separate the basic dough into one-quarter teaspoon portions. There should be enough dough for 10 or more pieces of incense.

Shape two portions of the dough with the fingers into cones. Any shape could be formed, but the cone shape is preferred since it will stand up without a holder; and the point of the cone facilitates lighting. Set the two shaped pieces on papers labeled "nothing added." These will be used when dry to compare with the pieces to which aromatic substances are added.

Now pulverize the frankincense as you did the gums. Add half of the powdered frankincense to one of the portions of dough, work it in thoroughly, and shape it into a cone. Set it on a paper labeled "frankincense" to dry. Wrap the remaining frankincense in waxed or similar paper, and put it in a safe, dry place. It is to be used later in another experiment.

Next, place a portion of the dough on a clean saucer. Add to it a drop of pure

vanilla extract. Mix thoroughly. Add charcoal powder as needed to keep the dough stiff enough to hold shape. Set the piece on a paper labeled "pure vanilla" to dry.

Place another portion of dough on a clean saucer and add a drop of synthetic vanilla extract (vanillin). Follow the same procedure as for the pure vanilla. Shape it into a cone, and place it on a paper labeled "vanillin" to dry.

Now, take an orange or lemon peel and squeeze the oil from it over a clean plate. The oil may be extracted by folding the peel inside out at various points. When enough has spattered on the plate to be visible (altogether, at least a drop), wipe it up with another portion of the basic dough. Blend it in well. Place it on a paper labeled "orange" or "lemon," to dry.

Next, place another portion of the basic dough on a clean plate. Add to it less than a quarter teaspoon of a ground kitchen spice such as nutmeg, cloves, ginger, cinnamon, etc. You may add a flavor extract such as almond or peppermint, if you prefer; or you may combine some of these. If a liquid is used, it may be necessary to add more charcoal powder to keep the dough at a proper consistency. Press it out on a clean plate until it is

very flat, even and thin. Cut the edges to make it rectangular. Take two straws from a broom. Place them side by side on an edge of the dough. Roll the dough onto the straws until they are coated with one thickness of it. There may be enough for several of these. Leave one end of the straw free of dough. The finished piece should look like a thin sparkler. Place this on a paper on which has been written the name of the ingredient that was added to the basic dough. This shape is given particularly, because of its use in India where bamboo sticks are frequently coated with incense.

If there is more basic dough, explore with various other aromatic materials. Aromatics other than household items may be purchased at a drug store.

Set the prepared incense pieces aside and allow them to dry *thoroughly*. The time required depends partly upon the humidity of the room. If it is kept in a dry place at room temperature, it should dry in about twenty-four hours. Drying can be accelerated by placing the pieces in an oven at very low temperature.

Experiment 9. Examine the finished, dried incense pieces. Notice that they weigh very little. Why did they lose so much weight, yet retain their size and

shape? Which of the pieces give off odor now? Do they smell like the materials you added? Is there any odor given off by the peices to which you added no aromatic substance? Notice the hardness and dry texture of the pieces. Before they dried, the texture was smooth and gelatine-like.

Experiment 10. If you are not familiar with the odor of burning charcoal, light a small piece and notice the odor. Now, move one of the pieces of incense labeled "nothing added" to a surface that will not burn or scorch. Keep the identifying paper next to it. Hold the cone by its base, and light the point. Do not allow it to burn with a flame. Place it back on the burnproof surface and notice its odor.

Experiment 11. Repeat the procedure for lighting the cone as in experiment 10, using the piece to which frankincense was added. Does the fragrance of the frankincense remind you of any other odor? Compare it with the burning incense to which no aromatic substance has been added. Can you describe the smell of the frankincense? Notice that it is not easy to describe odors in specific terms, as you can colors, for instance.

Experiment 12. It would be better to

wait after burning each piece for the odor to fade before lighting another. You may wish to allow the incense to smolder only long enough to note the odor. Light the pure vanilla scented incense, and the vanillin scented incense. Can you detect any difference between the odor given off by the pure vanilla and that given off by the synthetic, vanillin?

Experiment 13. Now, take the piece of incense to which either orange or lemon oil was added. Notice its odor before lighting. Light it as you did the other pieces. How does the odor of the fumes given off now compare with the odor before it was lighted? Does the odor have anything in common with the odors that were given off by frankincense or vanilla? If the piece containing no aromatic substance has stopped burning, light the other piece. Compare the odor of the orange or lemon scented incense with that of the non-scented piece.

Experiment 14. Burn a broom straw which is not coated with incense. Note the odor. Now, light the incense which is coated on straws. Can the aromatic material added in its preparation be identified as it burns? Is the odor similar to any of the other incense you have burned?

Experiment 15. Cut a charcoal brick

in half. Care must be taken in cutting the brick, because it crumbles easily. A sawing motion, using little pressure, with a sharp knife can accomplish this. Flatten two sides of the charcoal, or make it into a square by scraping it gently with a potato peeler or knife. Light the charcoal by holding it with kitchen tongs or tweezers over a flame. Remove it from the flame as soon as it will continue to burn with a glow. Place the glowing piece of charcoal on a surface that will not burn or scorch. This is to serve the purpose of an incense burner. Take the remaining frankincense powder and sprinkle it on the hot coal. How does the scent compared with that given off by the prepared incense containing frankincense?

Experiment 16. After the odor of the frankincense has gone, sprinkle some of the other dry aromatic materials you used in making incense on the hot coal. Do their odors change when they are heated?

HISTORY AND USES OF INCENSE

Historical evidence indicates that the use of perfumes and incense is as old as civilization. Natural aromatic substances that were used so long ago are used today, and generally, for the same

purposes.

Incense is burned for its odor in religious rituals and other celebrations. Several reasons have been given for the origin of the use of incense in religious ceremonies. One is that man's sensitivity to odor prompted him to burn fragrant incense to please the deity. Another is that it was used to replace or neutralize offensive odors of burning sacrifice and the odor of the dead. A third is that the fragrant smoke rose and carried prayers to the gods who would be pleased by the odor and more likely to grant the wishes of the prayer.

It was used to combat foul smells due to unsanitary conditions, and to purify the dwelling places of persons after sickness. Evil spirits and demons were thought to be driven away by strong-smelling fumes.

There is certain evidence that the burning of incense was important in various rites of ancient Egyptians, Assyrians, and Babylonians. Back to the earliest period of their history, the Hebrews used aromatic substances, not only ceremonially as incense, but also to season food and wine, and to perfume their bodies and clothing. Ancient Greeks burned aromatic woods, herbs, flowers, etc., to perfume

their homes, and as part of the sacrificial ritual. The Romans also burned aromatic wood on their altars before aromatic gums, oils and resins came into use. These aromatics were not brought to Europe from Arabia by the Phoenicians until probably about the eighth century B. C. It is not known just how long incense has been used in India in religious ceremonies; however, its use is ancient and widespread. Fragrant wood, such as sandal and cassia, grow there in abundance and have always been used. Other countries which have ancient histories of using incense are Nepal, Tibet, Ceylon, Burma, China, and Japan. Not only did people of the "Old World" use incense, but also ancient Mexicans offered incense to their gods, used it at festivals, and at sacrifices. Aromatic herbs were put into reeds and smoked. A mixture of tobacco, aromatic oils, and leaves were smoked in the same way. Generally, countries which have the oldest civilizations, have the longest history of using incense.

It is thought that incense was not used in the Christian church until about the fourth century, and then its use was prob-

ably to replace foul odors in the catacombs in Rome. It did not become part of the services until about the fourteenth century.

Incense is burned ceremonially all over the world today by various religious sects. In the modern Western world, its use enters into the ceremonies of such large organizations as the Catholic, High Episcopal, and Greek Orthodox segments of the Christian church, and into Jewish ceremonies. Large religious groups of the modern Eastern World which practice the use of incense include the Buddhists, Hindus, Jews, Moslems, and Shintoists.

In some less civilized tribes, incense is used today to ward off evil spirits, and for protection from harm. Magicians and witch doctors burn incense in magical rituals and in treating the sick.

In well-developed modern civilizations, the use of incense is limited. The advent of synthetics and deodorants, and the relatively sanitary environment of well-developed countries make practical use of incense burning negligible.

Issued December 1961

Cut out label on other side and put on end of box

Things of science MEMBERSHIP

12 monthly experimental kits—\$5.00
(Add \$1 for outside U.S.A. addresses)